DC REMOTE 24-10

MAINTENANCE MANUAL

IDA CORPORATION

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SPECIFICATIONS

SUPPLY VOLTAGE	117 VAC 60Hz
SUPPLY POWER	Transmit 11 watts max. Receive 10 watts max. Standby 6 watts max.
OPERATING TEMPERATURE	-30 degrees C to 60 degrees C
LINE IMPEDANCE	Transmit 600 Ohms Receive 600 or 5K Ohms
AUDIO OUTPUT LEVEL	-10dBM to +30dBM S/N Ratio : 50dB
AUDIO INPUT LEVEL	-30dBM to +10dBM S/N Ratio : 50dB
LINE CONTROL	2 or 4 wire
LINE CONTROL VOLTAGE	130 vDC max.
LINE CONTROL CURRENT	6mA and 15mA : adjustable
MAXIMUM LOOP RESISTANCE	8000 Ohms Optional panel : 30,000 Ohms
AUDIO OUTPUT POWER TO SPEAKER	2 watts max. @ 1% distortion
DIMENSIONS	5" W x 9" D x 5" H
WEIGHT	4 Pounds
COLOR	Beige

Section 1.0

GENERAL DESCRIPTION

1.1 The IDA Corporation Series 24-10 DC Remote is an instrument of telephone size designed to remotely control a two-way radio base station over a DC phone line. The Adapter Termination Panel (Model: 20-15,16,17) located at the base station provides the control functions of transmitter keying, tone squelch disable and two-way audio interface.

1.2 The Model: 24-10 makes use of an optimum combination of linear integrated circuits and discrete devices to achieve high reliability and flexibility.

1.3 Operation of the Model: 24-10 is straight forward. A remote user receives incoming calls on the built-in speaker when the handset is in the cradle position. Lifting the handset from the cradle, mutes the loudspeaker and transfers audio into the earpiece. On the standard Series 24-10, the action of lifting the handset also activates the low current(6mA) power supply that provides CTCSS disable for channel monitoring as required by FCC. Pressing the push-to -talk bar on the handset activates the microphone amplifier and places high current (15 mA) on the control lines thus energizing the base station transmitter. In addition, the transmit indicator on the faceplate will light. Replacing the handset in the cradle restores audio to the speaker and deactivates the low current power supply. Units equipped with two frequency control utilize dual polarity control functions thus providing four independent currents.

Section 2.0

INSTALLATION

2.1 RECEIVING INSPECTION

2.2 The Model 24-10 has been carefully packed for shipment. Upon receipt of the unit, it should be thoroughly examined for evidence of physical damage. Examine the enclosure exterior for damage and internally to insure that the printed circuit board and power transformer are firmly secured. In addition, check the faceplate wiring harness for proper seating within its socket. Any exterior and/or interior damage noted should be reported immediately to the shipper so that a damage claim, if applicable, may be filed with the carrier.

2.3 POWER INPUT

2.4 The model 24-10 requires 117 VAC @ 60 Hertz for correct operation. The AC line cord provided is a three-conductor type with the ground conductor connected to the chassis ground. For warranty and safety purposes, DO NOT clip the third prong of the AC line

cord to accommodate the old style two prong AC receptable. If a two wire receptable is only available, use an adapter plug and connect the green wire of the adapter to a suitable earth ground. If this isn't possible, attach the yellow wire on the DC phone line out of the remote to the chassis and connect it to a suitable earth ground. NOTE: If one of the above methods is not used for obtaining an earth ground, lightning damage may result to the unit.

2.5 TELEPHONE LINE CONNECTIONS

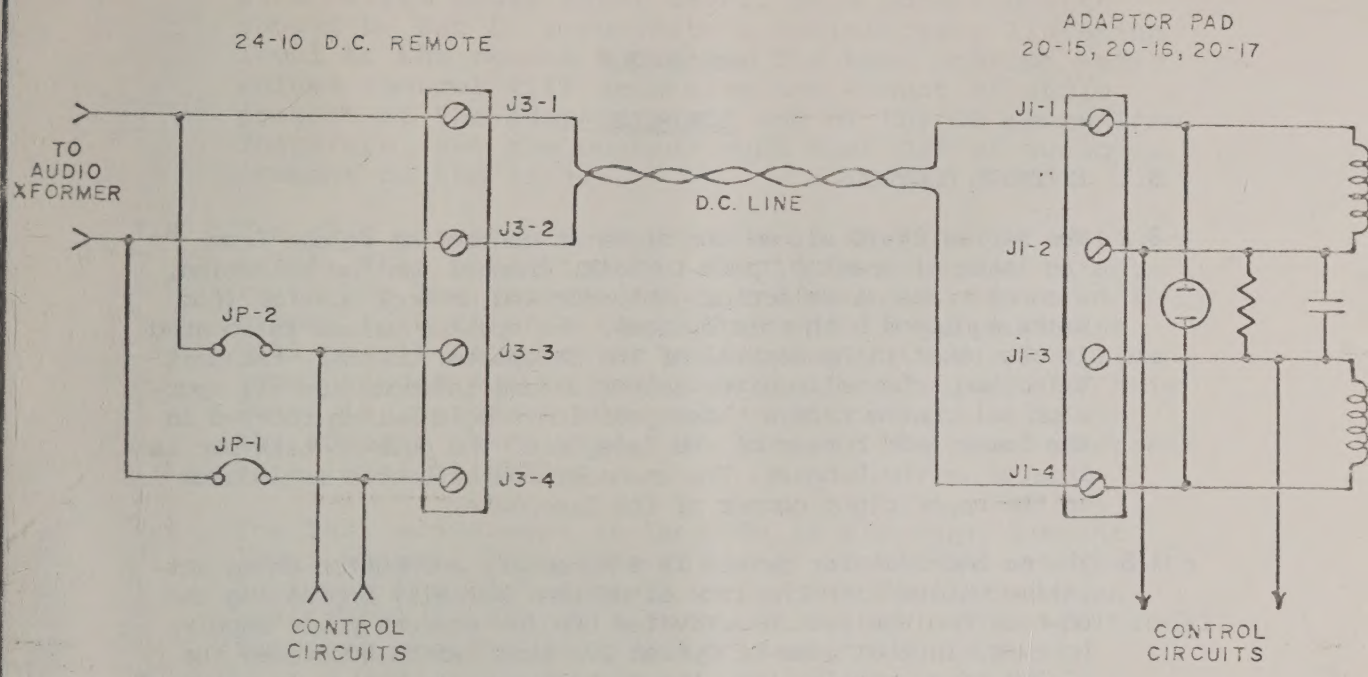
2.6 The Model 24-10 DC Remote may be operated using three types of telephone line connections. The choice of line connection is up to the remote end user who should consider cost and preformance of each. Simplexed connections are much lower cost then others, and in some instances there may be no choice at all.

2.7 Any transmission circuit of D.C. continuity capable of handling audio frequencys from 300 Hz to 3500 Hz can be used for remote control. One method of control utilizes one metalic pair for both audio signals and D.C. control voltages. See Method 1 schematic in this section. This method of control is most frequently used because it is economical and dependable where earth currents may be large, however,minimal keying clicks will be heard in paralleled remote control units.

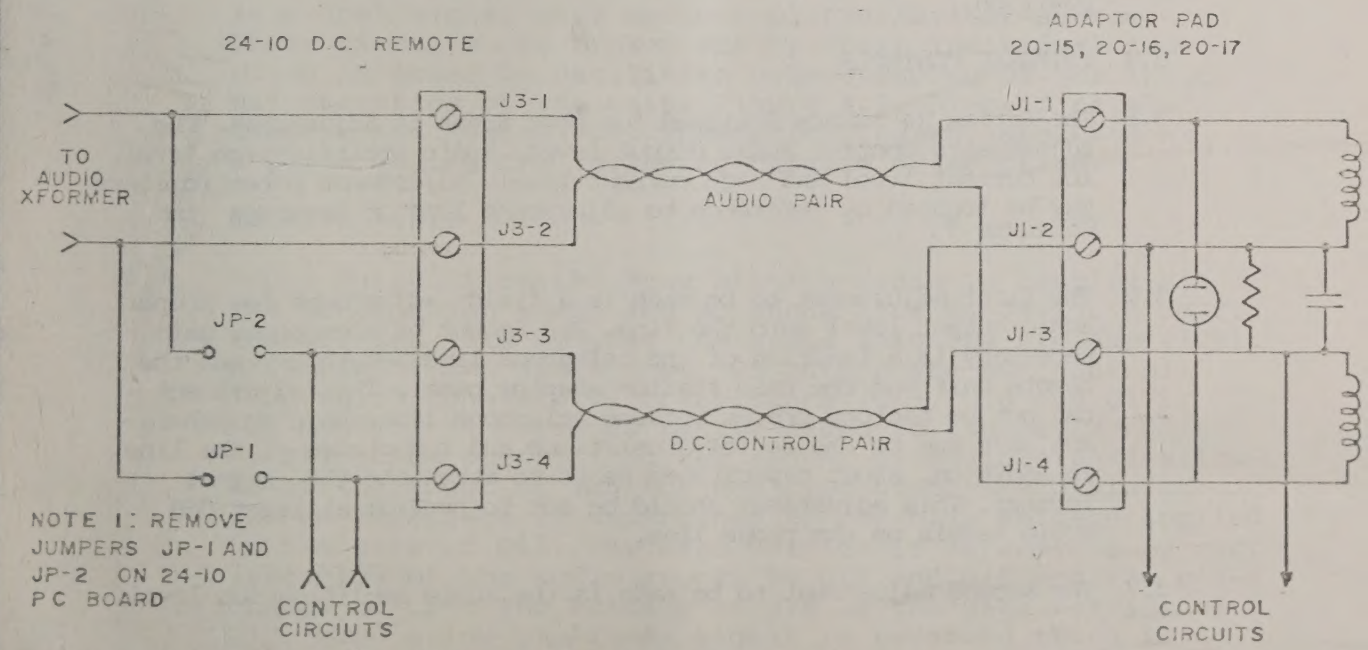
2.8 A second type of control utilizes two metalic pairs, one for audio and one for control voltage. See Method 2 in this section. This method of control provides the best performance inasmuch as keying clicks will not be heard in parallel units and it is not susceptable to ground currents which may interfere with control functions. This method does necessitate the use of two dedicated lines instead on one, hence is more expensive.

2.9 A third type of control utilizes one metalic pair for both audio and control voltages with control voltages simplexed from line to earth ground. This method is not any less expensive than the first and will result in earth ground current interference, therefore Method 1 is recommended.

TELEPHONE LINE CONNECTIONS



METHOD 1 - SINGLE TELEPHONE PAIR WITH CONTROL SIMPLEXED LINE TO LINE



METHOD 2—SEPARATE CONTROL AND AUDIO PAIRS

FIGURE 2.1

Section 3.0

CONTROLS

3.1 EXTERNAL CONTROLS

3.2 The Series 24-10 allows the operator control of volume from the internal speaker, push-to-talk, channel monitor selection, channel transmit selection, intercom and on-hook monitor (for units equipped with this option). The speaker volume is located in the lower right control of the faceplate. Channel transmit selection, channel monitor selection and intercom are all operator selectable from a three position toggle switch located in the lower left corner of the faceplate. The push-to-talk bar is located in the handset. The on-hook monitor button is located in the upper right corner of the faceplate.

3.3 The on-hook monitor switch is a momentary pushbutton whose actuation varies with the type of option. Normally depressing the on-hook monitor switch activates the low current power supply; however, in the case of Option 227 this switch activates the -2.5mA power supply. When the on-hook monitor button is released, 0 current will be present on the DC phone line until the PTT is activated. With Option 229, the on-hook monitor button will activate the -2.5 mA power supply when the frequency selector switch is in F1 position and -5.5mA Power supply when the frequency selector switch is in the F2 position. And with Option 214 , the on-hook monitor button will activate the -6mA power supply when the frequency selector switch is in F1 and the -15 mA power supply when the frequency selector switch is in the F2 position.

3.4 INTERNAL CONTROLS

3.5 The Series 24-10 are designed for four areas of adjustment. The adjustments control audio output level, audio amplification level, low current level and high current level. Adjustment potentiometers may be located by reference to adjustment locator drawings in Section 7.

3.6 The first adjustment to be made is a field adjustment for proper audio output level into the line. The amount of microphone gain necessary is a function of the telephone line length between the remote unit and the base station adaptor panel. This adjustment can not be factory preset because telephone lines have an inherant loss due to the series resistance and inductance of the line. In addition, shunt capacitance helps to attenuate the signal further. This adjustment should be set to provide at least 0dB audio levels on the phone line.

3.7 The second adjustment to be made is the audio amplification level,

also called audio input level. This potentiometer should be set to accomodate a satisfactory listening level at the remote location. The base station radio volume control will determine the amount of audio present at the adaptor panel end of the DC phone line. Therefore, set the control such that 0dB of audio is present on the line.

3.8 The next adjustment to be made is the low current level. This potentiometer should be set just to activate the low current relay and then turned an additional 1/10 th of a turn. This additional increase will result in a better performing unit because line loss changes due to environmental conditions. If this level is increased too much, the transmit relay on the adaptor panel will not release, therefore decrease this level slightly.

3.9 The last adjustment to be made is the high current level adjust. This potentiometer should be set just to activate the high current relay and then turned an additional 1/10th of a turn. As before, this additional increase results in a better performing unit.

SECTION 4.0

CIRCUIT DESCRIPTION

4.1 GENERAL

4.2 The Series 24-10 Remote utilizes an audio circuit which is a dual signal path audio amplifier/filter system. These circuits are broken out by their individual function in order to facilitate understanding of the internal operation of the unit. Figure 4.1, Simplified Block Diagram and Figure 7.1, Schematic Diagram, are used as a guide during the following circuit description.

4.3 RECEIVE AUDIO

4.4 Audio output from the base station radio is coupled via the termination panel and DC phone line to J3-1 and J3-2. Transformer (T1) couples the audio into the Pre-Amp (IC5). A sample of the audio from IC5 enters the AGC control loop which consists of transistors (Q19, Q18 and Q17). AGC control is obtained by the drain to source impedance of Q17, thus controlling the amount of audio signal allowed at the input of IC5 for amplification. The drain to source impedance is determined by the bias voltage applied to the gate of Q17. The bias voltage is determined by rectification of the audio signal by Q19 and Q18 and the discharge of C26. The voltage at C26 is the gate voltage of Q17. When a low amplitude signal is received there is a

smaller discharge of the voltage across C26, thus the drain to source impedance of Q17 is increased, allowing more signal to enter IC5 and be amplified. When a high amplitude signal is received, there is a large discharge of the voltage across C26 and the drain to source impedance is reduced, thus reducing the signal to be amplified. This action by the AGC control loop is such that a relatively constant amplitude signal is maintained at the output of the amplifier. Potentiometer (R31) controls the amount of audio that is applied to the Receive Audio Amplifier (IC4A) and thus should be set to provide a non-distorted audio that is heard at the Speaker or Handset Earpiece. Transistor Q3 shunts the receive audio whenever the PTT bar on the handset is pushed thus killing any audio output in the transmit mode of operation.

4.5 TRANSMIT AUDIO

4.6 Audio input from the Handset Mic is connected to J6 (Hot side) and J5 (common). Pre Amp (IC3) amplifies the transmit audio and a sample of the audio enters the AGC control loop which consists of transistors (Q15, Q14 and Q16). AGC control is obtained by the drain to source impedance of Q16 thus controlling the amount of audio signal allowed at the input of IC3 for amplification. The drain to source impedance is determined by the bias voltage applied to the gate of Q16. The bias voltage is determined by rectification of the audio signal by Q15 and Q14 and the discharge of C24. The voltage at C24 is the gate voltage of Q16. When a low amplitude signal is received, there is a smaller discharge of the voltage across C24, thus the drain to source impedance of Q16 is increased, allowing more signal to enter IC3 and be amplified. When a high amplitude signal is received, there is a large discharge of the voltage across C26 and the drain to source impedance is reduced, thus reducing the signal to be amplified. This action by the AGC control loop is such that a relatively constant amplitude signal is maintained at the output of the amplifier. Potentiometer (R7) controls the amount of audio that is applied to the Transmit Audio Amplifier (IC4B) and thus should be set to provide a 0dB output level on the DC phone line. Transistors Q1 and Q2 shunt the transmit audio when the PTT bar is not depressed. This kills any audio or noise to be transmitted during the receive mode of operation.

4.7 LOW VOLTAGE POWER SUPPLY

4.8 Low voltage AC is applied from the Power Transformer (T2) to terminals J2-1 and J2-2, these are the green leads of T2. This voltage is then rectified by the bridge comprised of D1, D2,D3 and D4. Capacitor (C19) filters out any ripple that is inherent from the bridge rectifier. Voltage reg-

ulator (IC1) provides a constant +15vDC output and IC1 is protected from short circuits and will shut down if the internal heat exceeds its preset level.

4.9 HIGH VOLTAGE POWER SUPPLY

4.10 High voltage AC is applied from the Power Transformer (T2) to terminals J2-3 and J2-4, these are the red leads from T2. This voltage is then rectified by the bridge comprised of D5, D6, D7 and D8. Capacitor (C20) filters out any ripple that is inherent from the bridge rectifier. Voltage regulator (IC2) samples the output voltage through resistor (R46) and from the internal voltage source through resistor (R35). When the PTT bar is not activated, transistor (Q7) is on and the 7.15 voltage source at pin 6 of IC2 is split between resistors (R35 and R37) and applied to pin 4. When the PTT bar is activated, Q7 is off and the 7.15 voltage source at pin 6 is coupled to pin 4. Pins 4 and Pin 5 of IC2 are the inputs to an internal amplifier whose output is pin 9,which controls the shunting transistor (Q4). When pin 9 is high, Q4 is on and base current through resistor (R38) is shunted away thus reducing the collector current through Q5. This state corresponds to the low level output current state of the unit. When pin 9 is low, Q4 is off and Q5 is thus allowed to completely turn on. This state corresponds to the high level output current state. Transistor (Q6) and resistors (R39 and R43) form a current limiting circuit that shunts base current away from Q5 when the voltage across R39 is sufficient to turn Q6 on.

4.11 POSITIVE POLARITY SWITCH

4.12 When the F1 position is selected, transistors (Q13, Q10 and Q8) are activated which allows currnt to follow out through JP2 and enter the DC Phone Line at J3-1. In addition, current returning through the DC line flows through J3-2 across JP1 which completes the circuit.

4.13 NEGATIVE POLARITY SWITCH

4.14 When F2 position is selected, transistors (Q11, Q12 and Q9) are activated which allows current to follow out through JP1 and enter the DC line at J3-2. In addition, current returning through the DC line flows through J3-1 across JP2 which completes the circuit.

4.15 TRANSMIT INDICATOR

4.16 When the Frequency Select Switch (S3) is in either F1 or F2 position, transistor (Q22) is energized which causes the Transmit Light (D16) to light when the PTT is activated thus indicating transmitter keying.

4.17 FREQUENCY SELECTOR

4.18 Switch (S3) controls the mode of operation which the unit shall perform. Its output through J1-2, 13 and J1-3 are only operable if the unit is off-hook or the Monitor Switch (S2) is depressed.

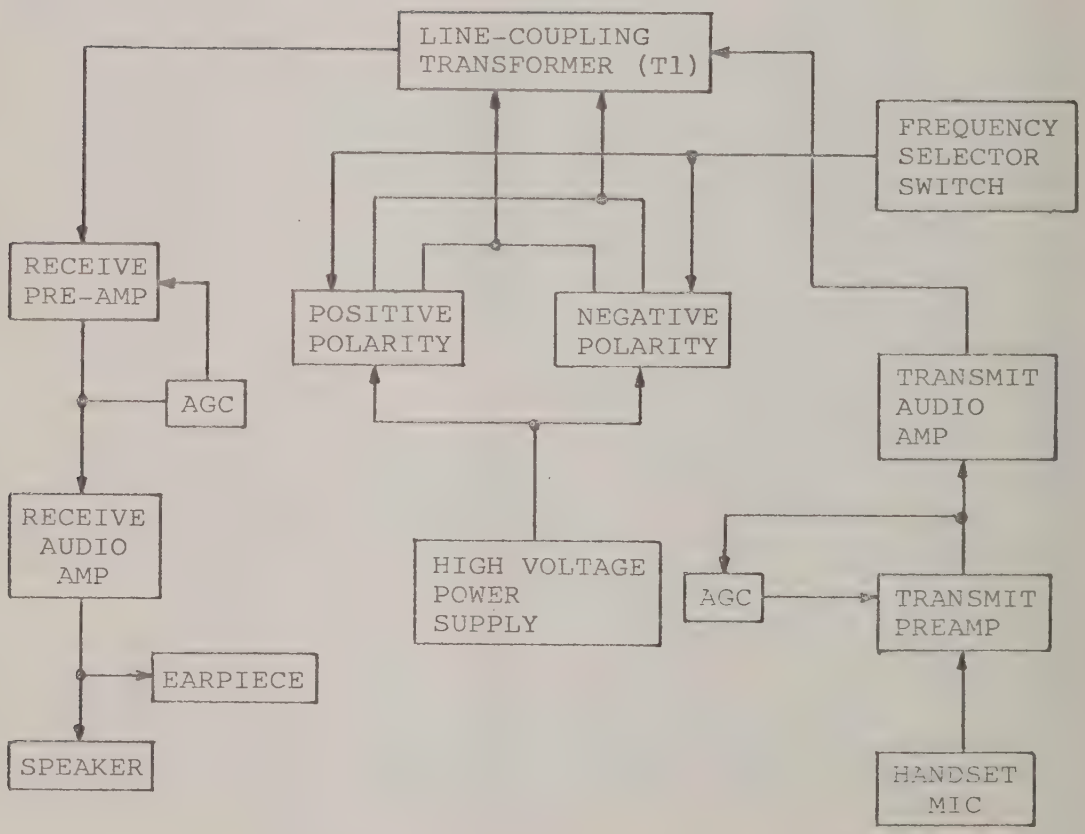


FIGURE 4.1

SECTION 5.0

TEST

5.1 GENERAL

5.2 The Series 24-10 DC Remote is designed for trouble-free, stable operation over a long period of time. The latest in solid-state design plus the selection of stable components, should provide a remote where no periodic alignment or adjustment is required. Good routine preventive maintenance procedures are required, however, to insure continued reliable operation. If difficulty is experienced in the operation of the unit, the following procedure is recommended:

a. Make sure the radio equipment, both transmitter and receiver are working properly.

b. Check to make sure the receiver is not producing a distorted audio output into the remote termination panel.

c. Check to see if the transmitter has the proper deviation or modulation.

d. Check the AC input as well as the output voltage of the 24-10 power supply.

e. Try to determine if the operational difficulty is within the 24-10 or the supporting phone line and radio system.

f. Substitution of a maintenance spare unit known to be good can determine if the unit requires service.

g. When it is determined that the 24-10 requires maintenance it can be returned to the factory for servicing. Factory maintenance is performed at no charge on failures which conform to the warranty terms. The warranty is contained at the end of this manual.

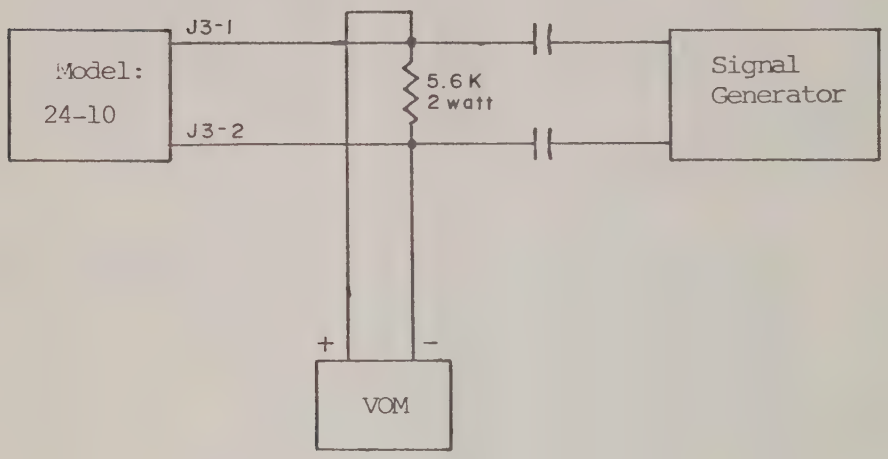
h. If maintenance service for trouble shooting or alignment is desired to be performed, refer to the following paragraphs.

5.3 TEST EQUIPMENT

EQUIPMENT	PURPOSE
1. DC coupled oscilloscope capable of inspecting waveforms less than 5MHz	Inspection of wave forms and control levels.
2. VOM capable of DC voltage and amperage measurements	To check proper voltages and currents
3. Signal Generator capable of generating frequencys from 300Hz to 3000Hz.	Generate receive audio

5.4 TEST SET UP

5.5 Use the test set-up in Figure 5.1 as a guide and perform the tests discussed in the following paragraphs.



5.6 POWER TEST

5.7 With the Model 24-10 Remote connected to 117 VAC power, measure the 15 vDC at J8 of the handset termination strip. Also, measure the voltage present across capacitor C20. This should be 140 vDC. Any shorts on the printed circuit board will shut the regulator down or blow the power supply fuse. To isolate a short:

1. Carefully inspect the board for any debris that may be shorting it. Use an air hose to clean it if possible.
2. Check for very warm or hot IC's by touching them. Many times this will isolate the problem.

If the +15 vDC is not present and the green leads of T2 are 19 VAC and there are no shorts on the PC board, then replace the voltage regulator (IC1). If the +140 vDC is present around C20 then trouble-shoot the high voltage supply according to the following procedure;

1. Measure the voltage at the base of Q5, this should be 0.6 volts less than the output line voltage. (transmit approx 100 vDC, monitor approx 40 vDC)
2. If the base of Q1 is low, measure the voltage at pin 9 of IC2. If this level is 0.6 volts or less, remove Q4 and re-measure the base of Q5.
3. If the base of Q5 comes up to +100 vDC or more, replace Q4.

4. In those cases where pin 9 of IC2 is high and the High Voltage Adjustment (R46) and Low Voltage Adjustment (R37) are turned to their maximum levels, replace IC2.

5. If after removing Q4 the output line level doesn't come up to +100 vDC or more, replace Q5. Then reinstall Q4 and set levels.

6. If all the above procedures do not bring the line levels up to operating status refer to the Polarity Control Section listed below.

5.8 POSITIVE POLARITY CONTROL

5.9 With the selector switch (S3) in F1 position check the base of transistors (Q13 and Q10), These should be 0.6 volts DC. In addition, the collector of Q8 should go to 40 vDC in monitor and 100 volts DC when transmitting. Also check diode (D13) for conduction when Q8 is on. This polarity should produce a positive voltage at J3-3 and a ground at J3-4. If one of the above components is not functioning, remove and replace it.

5.10 NEGATIVE POLARITY CONTROL

5.11 With S3 in F2 position check the base of transistors (Q12 and Q11), these should be 0.6 volts DC. In addition, the collector of Q9 should go to 40 vDC in monitor and 100 volts DC when transmitting. Also check diode (D12) for conduction when Q9 is on. This polarity should produce a positive voltage at J3-4 and ground at J3-3. If one of the above components is defective, remove and replace it.

5.12 TRANSMIT INDICATOR

5.13 With S3 in F1 or F2 position transistor Q22 should be on. When the PTT bar is activated, LED (D16) should energize indicating the transmit condition. Q22 is de-energized during ICOM thus symbolizing no transmitter keying. If one of the above components is defective, remove and replace.

SECTION 6.0

ALIGNMENT

6.1 GENERAL

6.2 This section of the 24-10 manual presents the procedure to be followed to properly align and set-up the unit. Refer to the schematic and overlay pictorials given in Section 7 to assist in the alignment.

6.3 RECEIVE AUDIO ALIGNMENT

6.4 Apply a steady 1000Hz tone of 0dB to the DC phone line input and set potentiometer (R31) until a clean, undistorted signal is heard in the speaker.

6.5 TRANSMIT AUDIO ALIGNMENT

6.6 Apply a steady 1000Hz tone to the handset mic input and set potentiometer (R7) until a 0dB signal is transmitted down the DC phone line.

6.7 HIGH CURRENT ALIGNMENT

6.8 With the handset PTT bar de-pressed, adjust potentiometer (R46) until 100 vDC is present on the DC phone line.

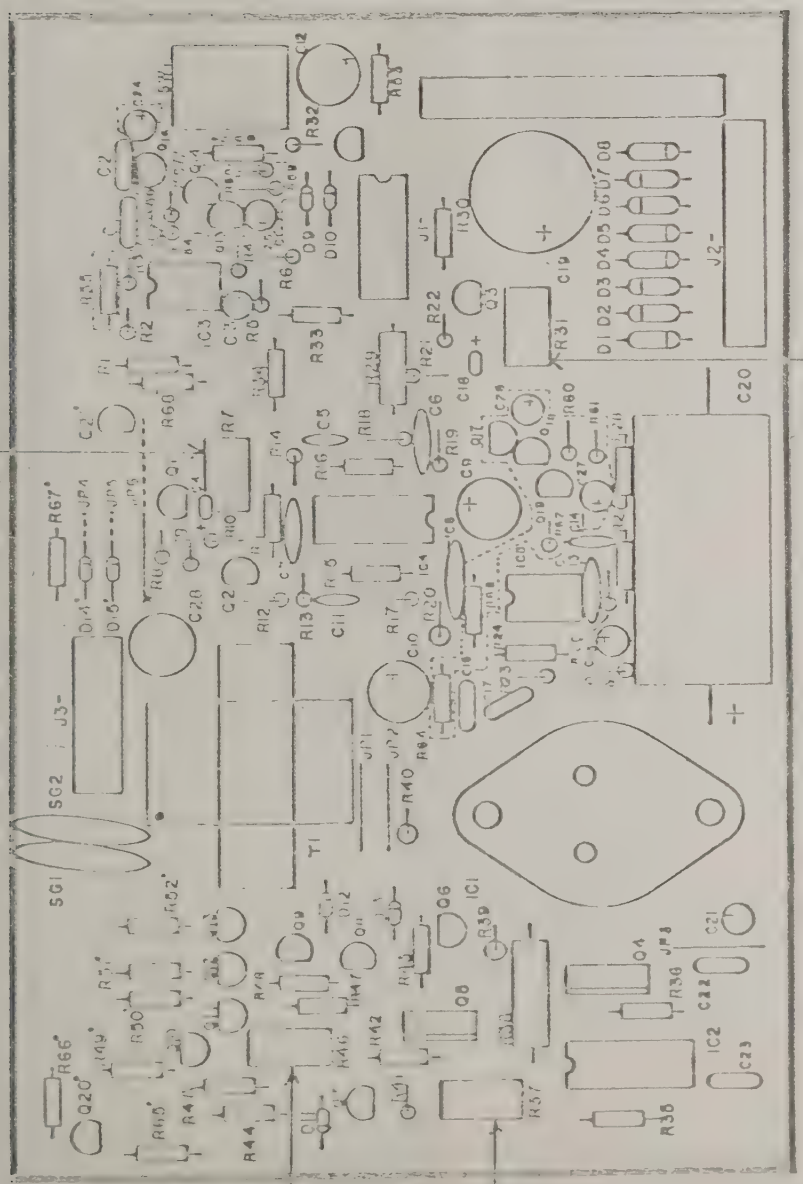
6.9 LOW CURRENT ALIGNMENT

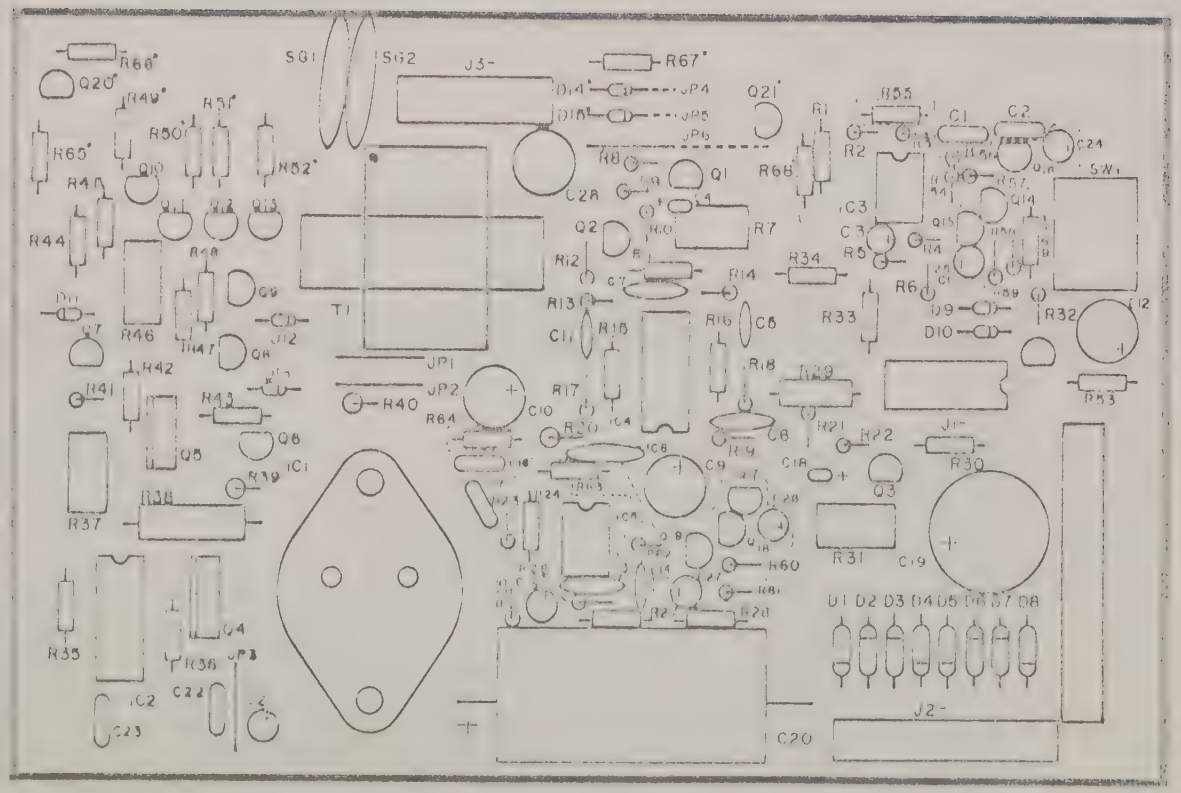
6.10 With the handset removed from its cradle adjust potentiometer (R37) until 40 vDC is present on the DC phone line.

SECTION 7.0

DRAWINGS AND PARTS LIST

ADJUSTMENT LOCATOR




SG1
SG2
J3-
T1
JP1
JP2
R40
R64
C10
IC1
IC2
IC3
IC4
Q1
Q2
Q3
Q5
Q8
Q9
Q13
Q14
Q15
Q16
Q18
Q20
Q21
R1
R2
R3
R4
R5
R6
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D15
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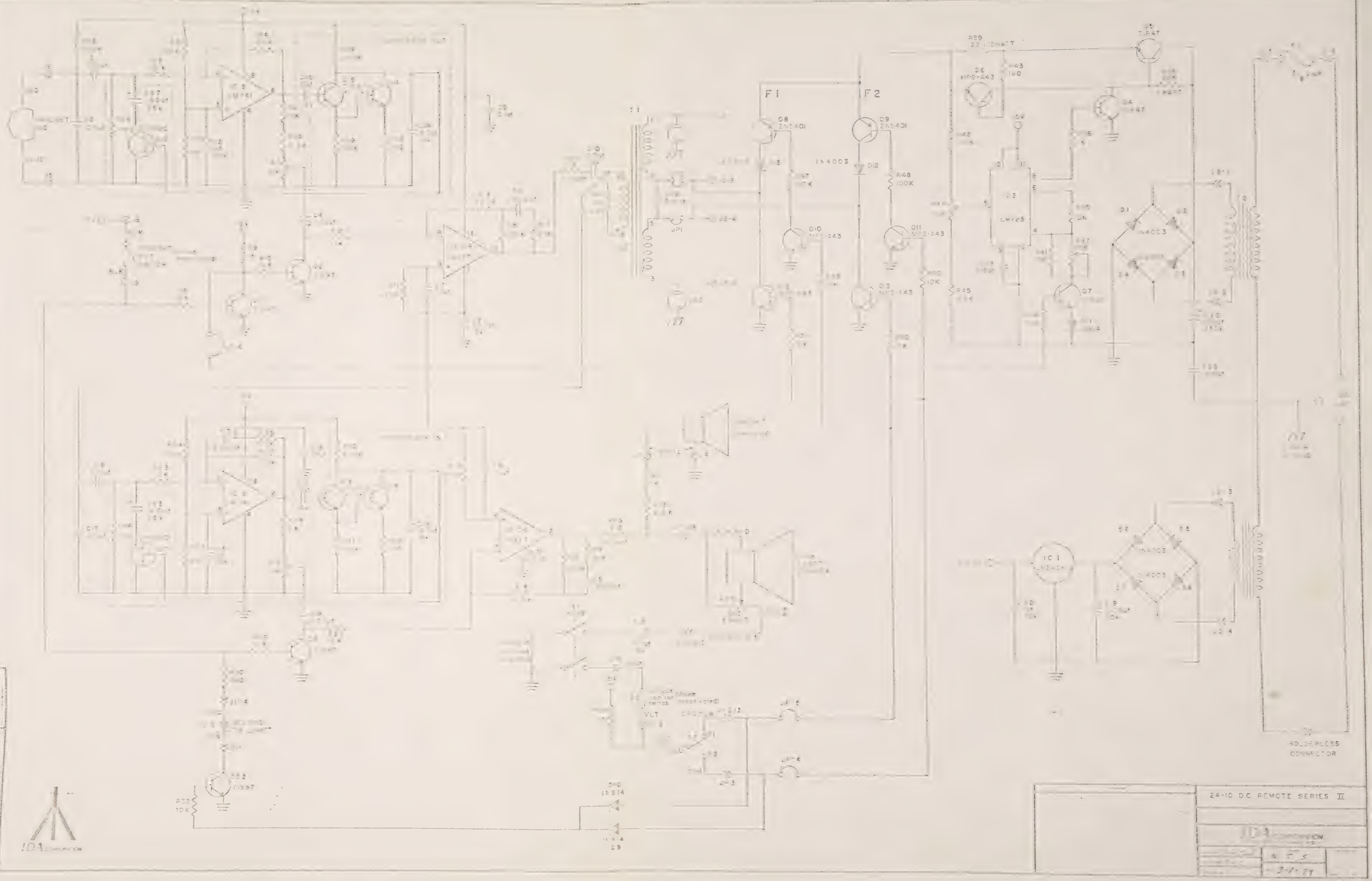
JP3
JP4
JP5
JP6
J2-
SW1


F1
F2
1N4003
1N4003
1N4003
1N4003
IC1
LM323
LM123
LM141
MPS-A43
2N5401
2N5401
MPS-A43
MPS-A43
MPS-A43
MPS-A43
T1
T2
T3
T4
T5
T6
T7
R39
22 1/2 WATT
R43
180
R48
100K
R45
R42
R40
1K
R41
10K
R38
10K
R37
10K
R36
10K
R35
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I D A CORPORATION

D.C. REMOTE MODEL 24-10

REPLACEABLE PARTS LIST

KEY NO.	PART NUMBER	NAME, DESCRIPTION
		.015MF Mylar
		1MF/50 Electro
	390-0001	.22MF Tant.
	370-0002	3300pf Ceramic
	370-0001	0.1MF Ceramic
	370-0002	3300
C12	360-0005	1
		Ceramic
		pfCeramic
		1MF/50V Electro
		.022MF Mylar
		.015MF Mylar
	390-0001	.22MF Tant.
	360-0018	10MF/35V Electro
C20	360-0011	4.7MF/25V Electro
C21	360-0001	1MF/50V Electro
C22	390-0001	.015MF Mylar
C23	390-0001	.01MF Mylar
C24	360-0010	4.7MF/16V Electro
C25	360-0004	10MF/16V Electro
C26	360-0010	4.7MF/16V Electro
C27	360-0004	10MF/16V Electro
C28	361-0001	1MF XP/150V
D1	110-0002	IN4003 Diode
D2	110-0002	IN4003 Diode
D3	110-0002	IN4003 Diode
D4	110-0002	IN4003 Diode
D5	110-0002	IN4003 Diode
D6	110-0002	IN4003 Diode
D7	110-0002	IN4003 Diode
D8	110-0002	IN4003 Diode
D9	110-0001	IN914 Diode
D10	110-0001	IN914 Diode
D11	110-0001	IN914 Diode
D12	110-0001	IN914 Diode
D13	110-0001	IN914 Diode
D14	110-0001	IN914 Diode
D15	110-0001	IN914 Diode
D16	110-0001	IN914 Diode
IC1	130-0004	LM340K15
IC2	130-0005	7824
IC3	130-0016	LM301
IC4	130-0001	MC807
IC5	130-0010	LM741

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D.C.REMOTE MODEL 24-10

REPLACEABLE PARTS LIST

KEY NO.	PART NUMBER	NAME, DESCRIPTION
Q1	130-0001	TIS97 Trans.
Q2	130-0001	TIS97 Trans.
Q3	130-0001	TIS97 Trans.
Q4	130-0007	TIP47 Trans.
Q5	130-0007	TIP47 Trans.
	130-0008	MPS A43 Trans.
	130-0001	TIS97 Trans.
	8	2N5401 Trans.
	6	2N5401 Trans.
	130-0008	MPS-A43 Trans.
	130-0008	MPS-A43 Trans.
Q12	130-0008	MPS A43 Trans.
Q13	130-0008	MPS-A43 Trans.
Q14	130-0001	TIS97 Trans.
Q15	130-0001	TIS97 Trans.
Q16	130-0002	2N3820 Trans.
Q17	130-0002	2N3820 Trans.
Q18	130-0001	TIS97 Trans.
Q19	130-0001	TIS97 Trans.
Q20	130-0001	TIS97 Trans.
Q21	130-0001	TIS97 Trans.
Q22	130-0001	TIS97 Trans.
R1	312-0019	1K 5% ¼ W
R2	312-0003	100K 5% ¼ W
R3	312-0011	10K 5% ¼ W
R4	312-0003	100K 5% ¼ W
R5	312-0003	100K 5% ¼ W
R6	312-0011	10K 5% ¼ W
R7	351-0002	10K Pot.
R8	312-0011	10K 5% ¼ W
R9	312-0019	1K 5% ¼ W
R10	312-0011	10K
R11	312-0046	470K 5% ¼ W
R12	312-0011	10K 5% ¼ W
R13	312-0012	220K 5% ¼ W
R14	312-0012	220K 5% ¼ W
R15	312-0012	220K 5% ¼ W
R16	312-0012	220K 5% ¼ W
R17	312-0014	33K 5% ¼ W
R18	312-0014	33K 5% ¼ W
R19	312-0046	470K 5% ¼ W
R20	312-0040	2.2 5% ½ W
R21	312-0011	10K 5% ¼ W
R22	312-0011	10K 5% ¼ W
R23	312-0011	10K 5% ¼ W
R24	312-0003	100K 5% ¼ W
R25	312-0003	100K 5% ¼ W
R26	312-0003	100K 5% ¼ W

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D.C.REMOTE MODEL 24-10

REPLACEABLE PARTS LIST

KEY NO.	PART NUMBER	NAME, DESCRIPTION
		4.7K 5% ½ W
		680 5% ¼ W
R29	313-0040	2.2 5% ½ W
R30	312-0017	680 5% ¼ W
R31	351-0002	10K Pot.
R32	314-0011	4.7K 5% 1 W
R33	312-0041	5.2K 5% ¼ W
R34	312-0045	8.3K 5% ¼ W
R35	312-0023	3K 5% ¼ W
R36	312-0019	1K 5% ¼ W
R37	351-0002	10K Pot.
R38	314-0007	22K 5% 1 W
R39	313-0010	22 5% ½ W
R40	313-0010	22 5% ½ W
R41	312-0011	10K 5% ¼ W
R42	312-0003	100K 5% ¼ W
R43	312-0025	130 5% ¼ W
R44	312-0011	10K 5% ¼ W
R45	312-0035	3.3K 5% ¼ W
R46	351-0002	10K Pot.
R47	312-0003	100K 5% ¼ W
R48	312-0003	100K 5% ¼ W
R49	312-0011	10K 5% ¼ W
R50	312-0011	10K 5% ¼ W
R51	312-0011	10K 5% ¼ W
R52	312-0011	10K 5% ¼ W
R53	312-0019	1K 5% ¼ W
R54	312-0012	220K 5% ¼ W
R55	312-0047	3.3Meg 5% ¼ W
R56	312-0001	1.0K 5% ¼ W
R57	390-0001	.22MF Tant.
R58	312-	W
R59	3M1-	1.0K 5% ¼ W
R60	312-0039	200 5% ¼ W
R61	312-0003	100K 5% ¼ W
R62	312-0046	470K 5% ½ W
R63	390-0001	
R64	312	W
R65	31	¼ W
R66	110-0001	IN914 Diode
R67	312-0019	1K 5% ¼ W
R68	312-0011	10K 5%
	3M2-	W
T1	410-0001	Power Trans.
T2	420-0001	Power Trans.

Option 214

Remove R4
R51, R52
Remove JP
JP4 & JP5
Install IN914
R49, R50, R51
R52, R66, D14
& D15
Install TIS97
Q20 & Q21
Install 10K ¼ W
resistors at
R65, R67, R68
R69
Install D14 &
in short hol

Note: With Ju
JP6 in short
½" F1 & F2 wil
-6Ma Mon +15Ma
With Jumper JP6
long hole 1" F1
will have -6Ma
+6Ma TX
F2 will have -
Mon +15Ma TX

WARRANTY

The product covered in this manual is warranted to be free of defects in material and workmanship for a period of one year from date of shipment. This warranty does not apply to any parts damaged due to improper use, or violation of instructions. It does not extend to damage incurred by natural causes such as lightning, fire, floods, or other such catastrophes, nor to damage caused by environmental extremes, such as power surges and/or transients.

All warranty repairs must be performed by IDA Corporation, Inc.. No credit will be allowed for repair work attempted by the customer. In-warranty merchandise must be shipped freight prepaid to IDA Corporation, Inc. IDA Corporation will return, freight prepaid, the repaired or replaced equipment to purchaser, within the Continental United States. Equipment found NOT to be defective will be returned at purchaser's expense and shall include cost of handling, testing and returning of equipment.

Equipment for repair may be returned to the factory without prior written authorization. It is required, however, that a brief description of the defect be included with the equipment.

Out-of-warranty repairs will be billed at the rate of $14.00 per hour, plus components needed for replacement.